CLAIMS

1/ A method of densifying porous substrates for a matrix obtained by chemical vapour infiltration using a reactive gas containing at least one gaseous precursor for the matrix material, the method comprising the steps of :

- loading substrates for densification in a loading zone of an oven;

- heating the substrates in the oven so as to raise them to a temperature at which the desired matrix material is formed from the precursor gas(es) contained in the reactive gas;

- admitting the reactive gas to one end of the oven; and

- heating the reactive gas after it has entered into the oven by passing it through a gas heating zone situated upstream from the loading zone in the flow direction of the reactive gas in the oven;

- wherein the reactive gas is preheated prior to entering into the oven so that on entering into the oven it is brought to an intermediate temperature between ambient temperature and the temperature to which the substrates are heated.

2/ A method according to claim 1, wherein the substrates are raised to a temperature greater than 900°C and the reactive gas is preheated, prior to entering the oven, so as to be raised to a temperature of not less than about 200°C on entering into the oven.

3/ A method according to claim 2, wherein the reactive gas is preheated to a temperature no greater than 900°C prior to entering the oven.

4/ A method according to claim 2, wherein the reactive gas is preheated to a temperature no greater than 600°C prior to entering the oven.

5/ A method according to claim 1, wherein the reactive gas is preheated outside the oven by passing through a heat exchanger.

6/ A method according to claim 1, wherein the reactive gas is preheated outside the oven at a pressure which is substantially equal to the pressure that exists inside the oven.

7/ A method according to claim 1, wherein the reactive gas is preheated outside the oven at a pressure which is higher than that which exists in the oven, and is expanded prior to entering into the oven.

8/ A method according to claim 1, for densifying porous annular substrates for brake disks made of carbon/carbon composite material.

9/ A method according to claim 8, wherein the substrates are loaded into the oven in one or more annular stacks and the reactive gas from the gas heating zone is channeled into one of the two volumes constituted by the volume(s) inside the annular stack(s) and by the volume of the loading zone outside the annular stack(s), and an effluent gas is taken from the other one of the two volumes to be evacuated from the oven.

10/ A method according to claim 9, wherein the substrates are stacked so as to leave leakage passages between them, putting said two volumes into communication with each other.

11/ A method according to claim 9, wherein the substrates are stacked without leaving leakage passages between them, so that the reactive gas can pass from one of said two volumes to the other solely by passing through the pores of the substrates.

12/ A method according to claim 9, wherein the annular stacks are individually fed with reactive gas via respective passages through a wall of the oven.

13/ A method according to claim 12, wherein the preheating temperature of the reactive gas feeding the stacks of substrates is adjusted individually for each stack.

14/ An installation for densifying porous substrates by chemical vapour infiltration, the installation comprising :

- an oven,
- a zone for loading substrates into the oven,
- means for heating substrates in the loading zone,
- at least one inlet for admitting reactive gas into the oven,
- at least one gas heating zone situated in the oven between the reactive gas inlet and the loading zone, and
- at least one gas preheating device situated outside the oven and connected to at least one reactive gas inlet to the oven, so as to preheat the reactive gas before it enters the oven.

15/ An installation according to claim 14, wherein the preheating device comprises an electrical heater tube inserted in a duct for feeding reactive gas to the reactive gas inlet of the oven.

16/ An installation according to claim 14, wherein the preheating device comprises a gas boiler having at least one duct passing therethrough to convey a flow of reactive gas to be preheated.

17/ An installation according to claim 16, wherein the boiler is connected to an outlet for removing effluent gas from the oven so as to use at least a fraction of the effluent gas as fuel gas for the boiler.

18/ An installation according to claim 14, wherein the preheating device comprises an electrically heated oven having at least one tube passing therethrough to carry a flow of reactive gas to be preheated.

19/ An installation according to claim 14, further including an expander located between the preheating device and the inlet for reactive gas into the oven.

20/ An installation according to claim 14, wherein the preheating device includes temperature regulator means.

21/ An installation according to claim 14, for densifying annular substrates placed in a plurality of stacks, the installation including a plurality of heater zones each situated between a respective inlet for reactive gas into the oven and a respective location for an annular stack in the loading zone.

22/ An installation according to claim 21, having a plurality of individual feed pipes for preheated reactive gas connected to the reactive gas inlets into the oven.

23/ An installation acorn to claim 22, wherein the individual feed pipes are connected to a preheating device via a common pipe.

24/ An installation according to claim 22, wherein the individual feed pipes are connected to respective devices for preheating reactive gas.